LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Nov. 29-Dec. 3, 2010

From toxicity to life

LLNL's Jennifer Pett-Ridge, right, runs the NanoSIMS and analyzes some arsenic-grown cells from Mono Lake as NASA/USGS's Felisa Wolfe-Simon observes.

Arsenic -- an element that triggers death for most Earthly life forms --- is actually allowing bacterium to thrive and reproduce.

In a study that may prompt the rewriting of textbooks, a team of astrobiologists and chemists has found the first known living organism that can use arsenic in place of phosphorus in its major macromolecules. The new findings, published in the Dec. 2 *Science Express,* could redefine origins of life research and alter the way we describe life as we know it.

Oxygen, carbon, hydrogen, nitrogen, sulfur and phosphorous are the six basic building blocks of life on Earth. These elements make up nucleic acids, proteins and lipids -- the bulk of living matter.

The new study by the Laboratory and led by NASA and the U.S. Geological Survey has found that a bacterium isolated from Mono Lake may substitute arsenic for phosphorus to sustain its growth.

To read more, go to the Web.

So you want to be a rock n' roll star

Dona Crawford

Lawrence Livermore's Dona Crawford is one of the most visible leaders in the high performance computing (HPC) community.

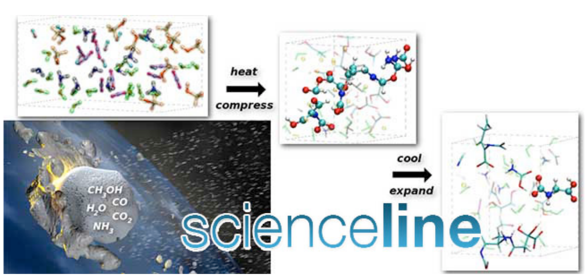
She's a community leader with the spirit, enthusiasm and love of life. From her days as one of the original leaders of the Accelerated Strategic Computing Initiative (ASCI) program, a national effort dating back to the early 90s, to her current position as associate director for Computation at the Laboratory where she is responsible for a staff of roughly 900, she has built a tremendous following of loyal employees and close friends.

Colleagues call Crawford a true leader who inspires and motivates with vision and passion. She is admired by her employees and peers, respected by her colleagues, and loved by her friends.

And now she is a rock star of HPC.

To read more, go to the Web.

Life on Earth as we know it



Computer simulations show that long chains containing carbon-nitrogen bonds can form during shock compression of a cometary ice. Upon expansion, the long chains break apart to form complexes containing the protein building amino acid glycine.

Life on Earth really could be from out of this world.

Laboratory research shows that comets that crashed into Earth millions of years ago could have produced amino acids -- the building blocks of life.

Amino acids are critical to life and serve as the building blocks of proteins, which are linear chains of amino acids.

LLNL's Nir Goldman and colleagues found that simple molecules found within comets (such as water, ammonia, methylene and carbon dioxide) just might have been instigators of life on Earth. His team discovered that the sudden compression and heating of cometary ices crashing into Earth can produce complexes resembling the amino acid, glycine.

To read more, go to the Web.

Now, that's heavy

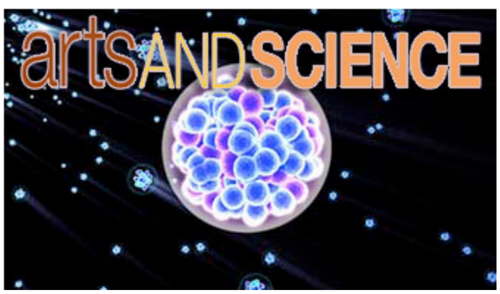


Illustration of the newly created element 117.

The discovery of new superheavy elements in the last few years means there are additions to the periodic table since you last perused it in a high school chemistry class.

One of those new elements, No. 117, was discovered by an international team of scientists led by Laboratory researchers as well as those from Vanderbilt University, the Joint Institute for Nuclear Research, Dubna, Russia; Oak Ridge National Laboratory; and the Research Institute for Advanced Reactors, Dimitrovgrad, Russia.

Element 117, which now goes by the name ununseptium (Latin for 117), has the distinction of being the world's heaviest element and one of the most newsworthy.

To read more, go to the Web.

Wish upon a star

A series of key experiments over the last month have brought scientists closer to the holy grail of energy production -- a working fusion reactor, or, in layman's terms "a miniature star on Earth."

Scientists at the National Ignition Facility think it can deliver on that lofty promise as soon as 2012. In one test, they fired up 192 laser beams into the center of their reactor, producing 1.3 million megajoules of energy.

The test broke world records; at its peak, the temperature at the reactor's core was roughly 6 million degrees Fahrenheit, a little less than a quarter the temperature of the center of the sun.

To read more, go to the Web.

More on the exotic side

The annual Supercomputing Conference this year, as always, managed to showcase a number of exotic machines, and among them, Livermore's Sequoia.

Sequoia will be installed in 2011 at the Laboratory and is intended to be the big production machine for the National Nuclear Security Administration's (NNSA) weapon simulation codes maintained under the Advanced Simulation and Computing (ASC) Program. Sequoia is slated to be a 20-petaflop system when it boots up next year.

To read more, go to the Web.
